

# Safe Water Storage in Hubli



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# Global Water & Health



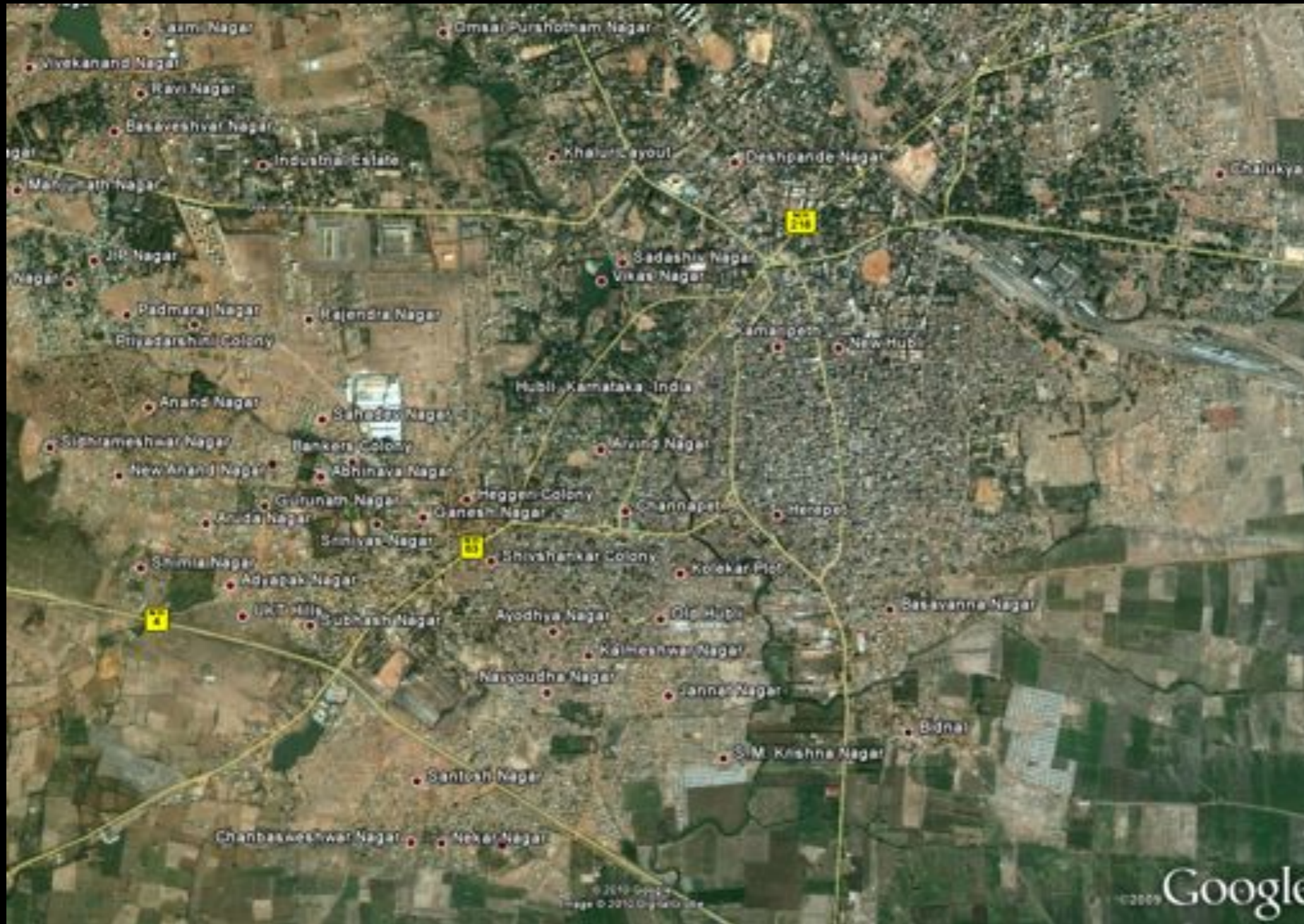
Photo credit: HMS team

- 2.2 million deaths annually through diarrheal disease, mostly in children under 5 years.
- Diarrheal disease exacerbated by contaminated water, poor hygiene, and inadequate sanitation.
- International focus on treatment, but not storage

# India



# Hubli



- 77 sq. miles (slightly larger than SF)
- 1.5 million people
- 2nd most populated urban area in the state of Karnataka

# Issues specific to Hubli



Photo credit: Devadanam Talapathi

- Intermittent (every 5-12 days) water supply from a tap
- Families collect water in matkas and transfer it to the main steel container, which comes in 3 basic sizes
- Households have multiple containers-that sit on the ground or on the counter
- Hand-water contact in this region is common when getting water

# Haath Mein Sehat (HMS)

## Needs Assessment Results

Figure 8: Most Important Concern Stated by Residents

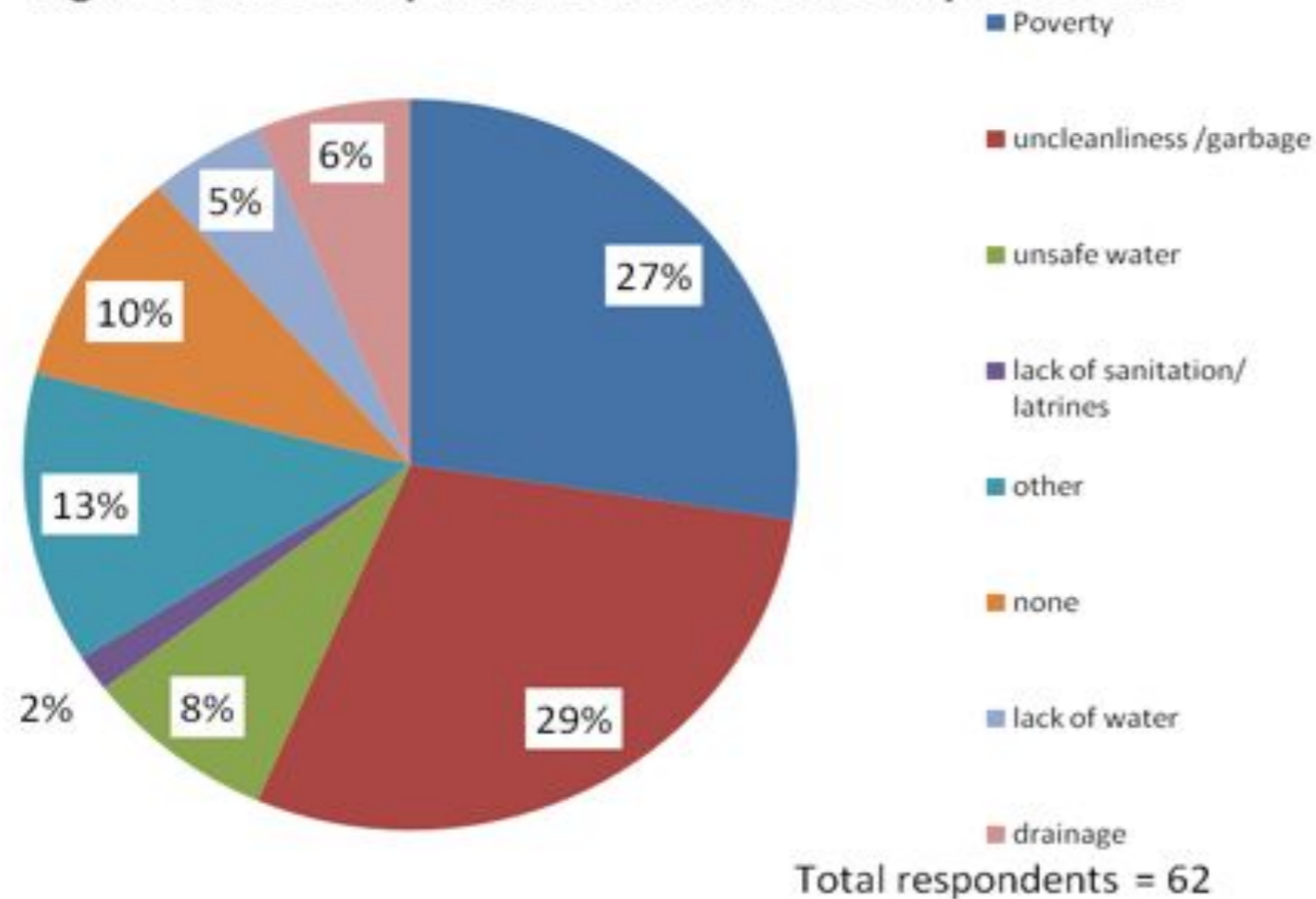
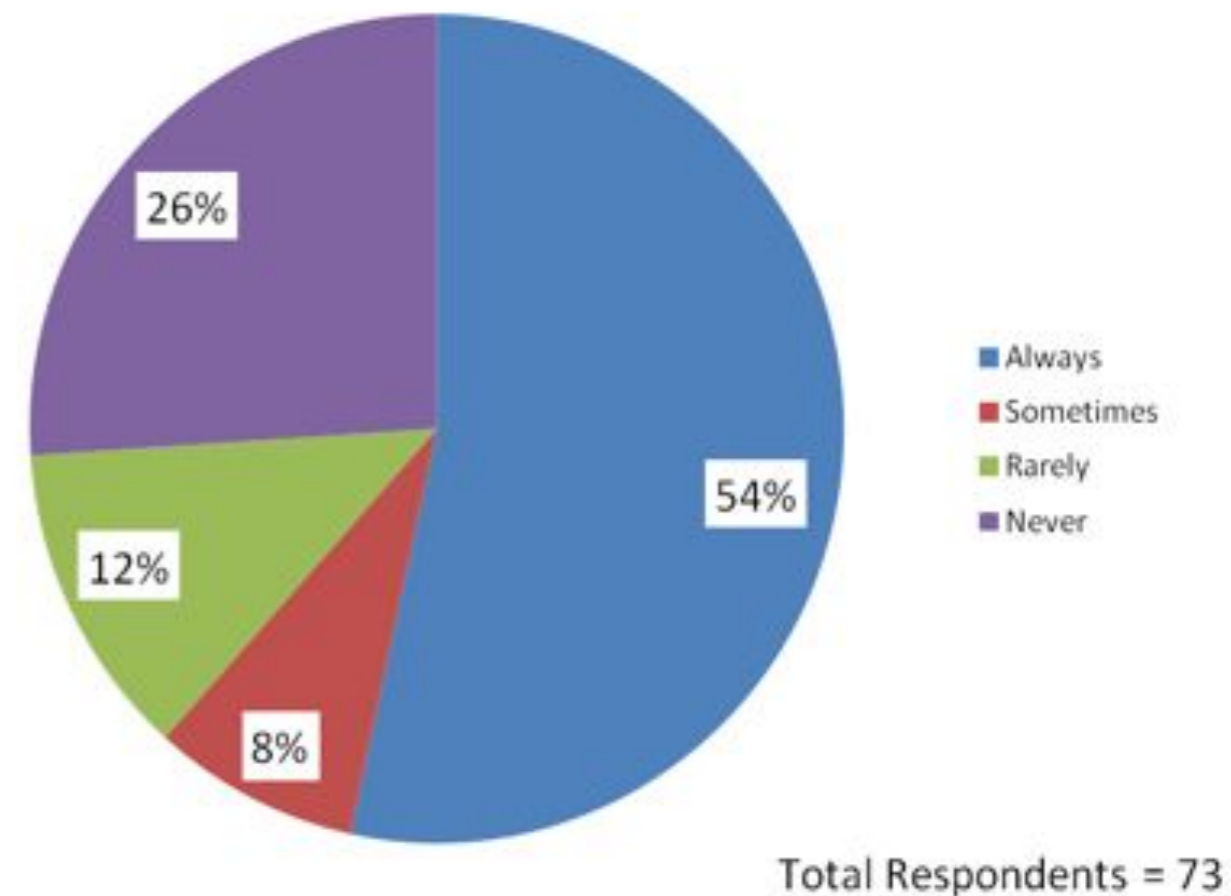


Figure 12: "Do you treat your drinking water?"



# Goal Statement



Photo credit: HMS team

Create a technology(-ies) that will minimize additional microbial contamination of drinking water after storage in homes.

# Goal Progression

- Water quality based initial goal
- Shift from water quality testing to cultural acceptability
- Focus on human-centered design
- Local materials/ methods

# Project Deliverables



Photo credit: HMS team

- Make proof-of-concept prototypes that can be used to collect feedback for cultural acceptability
- Prototypes must cover the range of existing containers/ conditions etc.
- Develop feedback/ monitoring & evaluation plan for summer

# Stakeholders in depth



Photo credit: HMS team

- Stakeholders: adult women (mothers), adult men (heads of household), children, donors (Deshpande Foundation)
- Most restrictive users: adult women and children of 3 years and older

# Design Criteria

Adult Women	<ul style="list-style-type: none"><li>• Operable by one person</li><li>• Quick access: equivalent flowrate ~ 100 mL/ s</li><li>• Materials must be perceived as “clean”.</li><li>• Low cost</li><li>• Maintain container integrity (no holes)</li></ul>
Child aged 3 year or older	<ul style="list-style-type: none"><li>• Access point less than 3 feet</li><li>• Must be sturdy, durable, stable</li><li>• Intuitive user interface</li></ul>

# Siphon Tap



Upper valve



Lower valve



- For containers at waist level
- Prototype cost ~ \$20
- Ready for acceptability feedback

# Siphon Tap: Lessons Learned

Copper pipe bending



Fluid flow problems



# Siphon Tap: Future Work



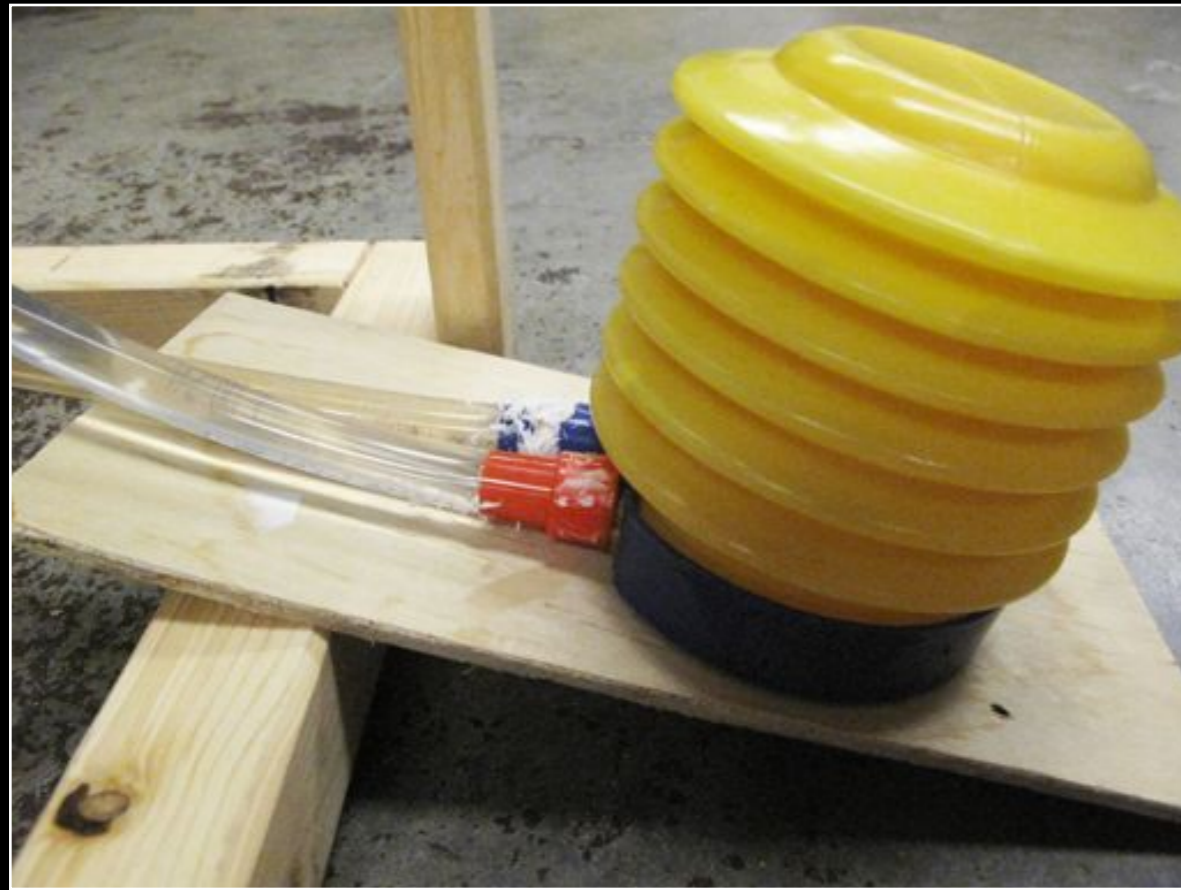
- Determine cultural acceptability
- Resolve air-water fluid flow issues
- Potentially use pre-fabricated valves
- Use different materials
- Determine cost-saving alternatives

# Handwash Station



Promoting Good Hygiene and Protecting  
Stored Water

# Handwash Station



foot pump-  
operated



~3 ft. tall

# Handwash Station

Benefits	Drawbacks
Dual purpose	Unsteady pumping
Foot pump limits hand-water contact	Leakage
Utilizes existing containers/bowls	Pump designed for air, not water
Inexpensive, standard materials	Low cost depends on materials sourcing
Sleek design	

# Water Lift

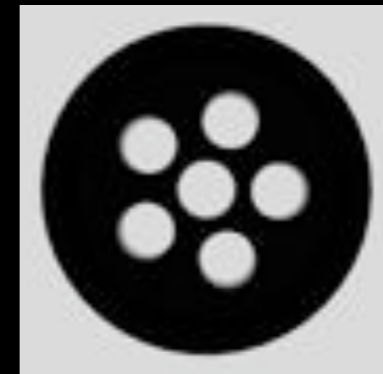


- Uses a piston to elevate a water column
- Addresses previous concerns about noise, usability, and responsiveness.
- Key point is it can be constructed from basic materials and a low level of technology

# Water Lift



Piston Valve



Valve Geometry



Valve Cap

# Water Lift



- Failed Ideas: Using layered epoxy to create machinable valves
- A better adhesive release agent is needed



# Dispenser



- Pre-packaged option
- Fully functional and locally supplied
- Ready for field testing with on-site retrofit

# Dispenser: Future Work



- Determine cultural acceptability and desirability
- Determine on-site vessel retrofit options
- Look for alternative local suppliers

# Prototype Summary

Siphon Tap	<ul style="list-style-type: none"><li>• Container at waist level</li><li>• Can be used with any container</li><li>• Prototype cost: \$20</li></ul>
Hand-wash Station	<ul style="list-style-type: none"><li>• One handed operation</li><li>• Dual purpose</li><li>• Prototype cost: \$30</li></ul>
Water Lift	<ul style="list-style-type: none"><li>• Container on floor</li><li>• Most suitable for straight walled vessels</li><li>• Prototype cost: \$15</li></ul>
Dispenser	<ul style="list-style-type: none"><li>• Pre-packaged engineered solution</li><li>• Cost: \$9 + cost of retrofit</li></ul>

# Lids and Interface



Photo credit: Devadanam Talapathi

- The action of drawing water introduces forces onto the water in the container
- Certain designs must translate forces to the container to keep the device in place (Water lift, Dispenser)
- Siphon Tap and Hand-Wash Dispenser do not have this problem
- Lid interface must still prevent hands going into the container

# Monitoring & Evaluation: User Preference



- 40 households: 10 siphon tap, 10 water lift, 10 dispenser, 10 control
- one week rotations
- surveys at conclusion of rotations
- focus groups

Photo credit: HMS team

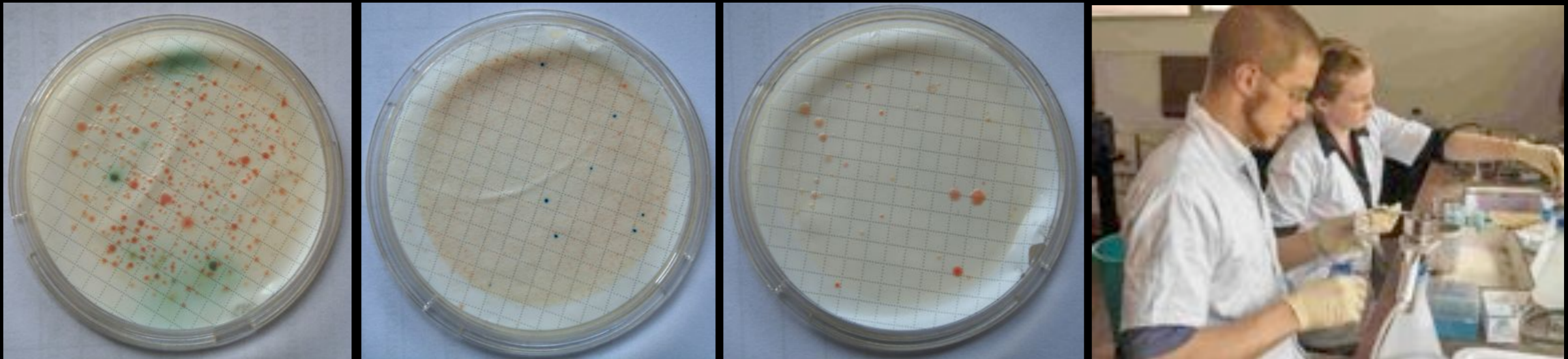
# Monitoring & Evaluation: Household Use?



Photo credit: HMS team

- Unannounced drop-ins
- Criteria for deciding if prototype is actually being used

# Monitoring & Evaluation: Water Quality Testing



- Compare water quality between households that are using a prototype versus households that are not
- Compare water quality of households to source (tap)
- Water quality testing station set up in Hubli

# Early Branding Ideas



- Sticker applied to lid retrofit
- Aesthetic appeal, branding potential, educational value

# Conclusions

- Flexible designs to be modified in the field.
- Work is never done: this is just the 1st part of a hopefully long investigation into safe water in Hubli.
- Safe water storage is just one of many solutions.
- Local partnerships and a sustained presence are essential.
- The technology needs to be coupled with health education

# Future Work: Alternatives



- Ladles
- Cheaper plastic prototypes
- Combined treatment + storage technologies
- Pure-It knockoff

# Thank you!

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